yolk-sac has disappeared, though the animal is shorter than a larval form two months before extrusion. Indeed, it is likely that the yolk was absorbed before extrusion, otherwise it would not have escaped attention so long.

In examining a number of pregnant females this winter, I have been struck with the frequent occurrence in the earlier stages of one or more deformed embryos. The deformity appears confined to the caudal region, which is bent, or even spirally twisted. Ryder * and others have shown that in some normal oviparous fish the tail of the embryo is affected in a similar way by unfavourable conditions of temperature. But it does not appear that any so-affected embryos hatched.

Here it is evident that the deformity, however caused, has had no effect on the embryo beyond retarding its growth. The little creature has the ordinary proportions of a larval form of the same length, and appears active and healthy, feeding greedily on Copepods.

The young blennies at this age lie quietly at the bottom of the vessel in which they are confined, ever and anon making a dart at a passing Copepod. They rarely rise into midwater, though Copepods are much more abundant near the surface than at the bottom.

On the Relationship of the Annelida and Mollusca.

By M. A. Giard.

In the Report on the great prize in the physical sciences published in the 'Comptes Rendus' of the 30th December, 1889 (p. 1055), it is said:—"What especially merits attention in the memoir of M. Roule is the place which he assigns to the Annelida in the animal series. *He makes them near relatives of the Mollusca.*"

With reference to this passage M. Giard remarks that long before both Roule and Hatschek he expressed the same opinion. In 1876, at the close of a note upon the development of *Salmacina Dysteri*, Huxl., he wrote as follows †:—

"*General results.*—The formation of the organs of sense independently of the nervous system, and before the completion of that system, the presence of ectodermic respiratory organs, the late origin of the circulatory apparatus, are so many characters approximating the embryo of *Salmacina* to that of the Mollusca. The divergence between the Mollusca and the Annelida only commences after the *Trochosphæra*-stage, and even after this stage the morphological agreements and histological resemblances between the two types are still very numerous. *The relationship of the Mollusca and the Annelida is certainly nearer than that of the latter to the Arthropoda*; the existence of metameres in the Arthropoda and the Annelida has

* 'Report of Commissioner U.S. Fish and Fisheries Commission,' 1885, p. 532.

† 'Comptes Rendus,' January 24, 1876.

masked the true affinities in the eyes of naturalists. It is among the Rotifera that we must seek the origins of the three groups; the Gastrotricha lead to the Annelida through the genus *Hemidasys* *. . . . . The affinities of the embryos of the Gasteropoda with those of the Rotifera (*Brachionus*) have already been brought to light by the fine investigations of Salensky."

Somewhat later † the author maintained that the perfect agreement furnished by the superposition of the first embryonic stages and the general presence of the *Trochosphæra*-stage in the Mollusca, Polychætous Annelida, Rotifera, Brachiopoda, and Bryozoa show clearly that these various groups belong to a single mass. To the objection that the embryogeny of the Oligochæta, Hirudinea, Cephalopoda, and Nematoda presents considerable differences from that of the above types, he replies that these groups are so united to the preceding ones by a series of forms allied anatomically and organogenetically that we must regard them as the extremities of those branching series of which Lamarck indicated the existence in the heart of his fundamental masses. Some of them perhaps (Nematoda, Oligochæta) diverged from the common stem before the *Trochosphæra*-stage. External form may be misleading—there is more difference between an *Ascaris* and a *Serpula* than between a *Serpula* and a *Terebratula*. From the anatomical conformity between the Oligochæta and the Polychæta it would seem that, at least in this case, there has simply been falsification of the embryogeny in the former. As *Euaxes* and *Lumbricus* issue from the ovum nearly in the adult form, the *Trochosphæra*-stage has been suppressed. In *Limnæus* the embryo leads a half-free life in the liquid which surrounds it, and we find a Trochosphere reduced in proportion to the freedom of movement.

In 1878 ‡ the author insisted again upon the necessity of creating for the Mollusca, Annelida, and satellitic groups, a group equivalent to the Vertebrata and Arthropoda, for which he proposed the name of *Gymnotoca*. It was characterized anatomically by the existence of a secondary excretory system (deutonephra or segmental organs) replacing the primary excretory system (protonephric system), the existence of which is permanent in the ancestral group of the Platyelmintha. The phylum Gymnotoca was divided as follows :—

GYMNOTOCA
1. Mollusca: Cephalopoda, Gasteropoda, Acephala, Scaphopoda, Polyplacophora, and Neomenida.
2. Annelida: Chætopoda, Gymnotoma (*Polygordius*), Hirudinea, Gephyrea, Chætognatha, &c.
3. Brachiopoda.
4. Ciliata: Rotifera, Gasterotricha, Bryozoa.

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* M. Giard now regards *Dinophilus* as more ancestral, but this is only of secondary importance here.

† 'Revue Scientifique,' March 18, 1876, p. 277.

‡ Bull. Sci. du Nord, 1878, pp. 47 *et seqq.*

From the embryogenetic point of view the Gymnotoca are characterized by the *Trochosphæra*-larva, like the Arthropoda by the *Nauplius*-embryo.

The phylogenetic table of the Gymnotoca given by M. Giard in 1876 may be compared with the genealogical tree of the Trochozoa prepared by M. Roule in 1889, and, according to the author, the only essential alteration consists in the adoption by the latter of Hatschek's term Trochozoa.

In attempting to homologize the schizocœle of the higher Gymnotoca with the enterocœle of the more archaic forms (*Sagitta*, Brachiopoda), the fact that the original mesodermic cells in the schizocœlian types originate from the endoderm, at the margin of the prostomium, in points perfectly homologous with those in which the endodermic diverticula are formed in the enterocœlians, led the author at first to regard the latter as representing the primitive state, of which the derived (condensed) form is realized in the Mollusca and Annelida. His later researches have enabled him to generalize this interpretation and to formulate the following empirical law:—

"*When, in the development of allied animals, an organ originates either by invagination or folding of a cellular lamella (Wolffian process), or by the formation of a solid cellular mass which is afterwards cleft or hollowed by a cavity, the latter mode of formation must be regarded as a condensation of the former.*"

This formula may be applied to the Gymnotoca not only in the question of the two forms of mesoderm, but also in the comparison of the *archigastrula* (*Sagitta*, Brachiopoda) and of the derived modes of gastrulation in the formation of the ventral nervous system by a furrow (*Salmacina*, *Protodrilus*) and by thickening &c. With regard to the nervous system and to the ectoderm generally the author states that in no Annelid examined by him has he seen anything like the syncytium described by M. Roule. The contours of the ectodermic cells can always be shown by suitable reagents.—*Comptes Rendus*, January 15, 1890, p. 90.

On the Fauna of Mountain-lakes. By Dr. F. Zschokke.

The faunistic investigation of three neighbouring alpine lakes of the Rhætic Alps, the dividing chain between Vorarlberg and Graubünden, gave the following results:—

a. *Lake of Partnun*: elevation 1874 metres; length 450, breadth 200, depth 35 metres; temperature 9°·5–10°·5 C. The basin is enclosed by lofty rocky walls in the midst of the limestone mountains; its bottom consists partly of fine mud, partly of coarse gravel. A green Algal vegetation is rather luxuriantly developed in the lake, while the banks are scantily covered with plants. Almost throughout the whole summer the basin receives a great influx of